

Name \_\_\_\_\_  
Date \_\_\_\_\_ Period \_\_\_\_\_

## Conservation of Energy Lab

I. Purpose: To investigate how potential energy is changed into kinetic energy. A mass falling toward the floor will pull a cart along a horizontal table. The change in potential energy of the falling mass shows up as kinetic energy if frictional forces are small.

II. Materials: wheeled cart  
mass set  
electronic balance  
string  
meter stick  
stop watch  
table clamp pulley

### III. Procedure:

#### Case 1

1. Measure the mass of the cart and the mass of the 100g mass. Record these masses on the data table. Be sure to include correct units.
2. Attach the string between the 100g mass and cart and place the string over the pulley fastened to the edge of the table. The 100g mass should hang over the edge of the table. The string should be long enough so that the mass hang over the edge of the table and fall to the floor without having the cart go over the edge of the table too.
3. Measure the distance the mass will fall as it goes from the edge of the table to the floor. Record this distance, with correct units in the data table.
4. Measure the time it takes for the 100g mass to go from just over the edge of the table to the floor. Start the clock when the cart is released and stop it when the mass hits the floor. Run a few trials and use the average time in your calculations.

#### Case 2

5. Repeat the procedure for Case 1, substituting a 200g mass for the 100g mass.

#### Case 3

6. Repeat the procedure for Case 1, adding masses to the cart to double its original mass and use a 200g falling mass.

MAKE SURE THAT YOU MEASURE THE DISTANCE THE MASS FALLS FOR EACH CASE. THE MASSES DIFFER IN LENGTH, WHICH AFFECTS THE DISTANCE THE MASS FALLS.

~~350~~  $500 \text{ kg}$   $\frac{500 \text{ g}}{1000 \text{ g}} = \frac{1000 \text{ kg}}{1 \text{ kg}} \cdot 500 \text{ kg}$

IV. Data:

Case 1

Case 2

Case 3

$E$  Mass of cart  $\text{kg}$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

$E$  Mass of falling mass

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

$M$  Distance mass falls  $\text{m}$  ✓

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

$C$  Total mass  $\text{kg}$   
(cart + falling mass)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Average Time  $\text{sec} \sim 0.37$

\_\_\_\_\_

\_\_\_\_\_

Trial times

①  $\sim 0.3$   
② \_\_\_\_\_  
③ \_\_\_\_\_



\_\_\_\_\_



\_\_\_\_\_



V. Analysis:

1. Find the average time for the mass to hit the ground for each case. Record this value in the data table. Be sure to include correct units.

2. Find the average velocity of the cart for each case using the equation  $v = d / t$ . Where "d" is the distance the mass fell and "t" is the time it took to fall.

3. Given that the cart starts from rest, the final velocity will be twice as great as the average velocity. Find the final velocity that the cart and mass were going just before the falling mass hit the floor using the equation Final Velocity = 2 x avg v. Calculate the change in potential energy for each case, using the equation  $PE = mgh$ . Where "m" is the mass of the falling mass, "g" is the acceleration due to gravity and "h" is the distance the mass fell.

(Only the falling mass changed in PE)

Calculate the increase in kinetic energy for each case, using the equation  $KE = \frac{1}{2} mv^2$ . Where "m" is the total mass of the system (cart + falling mass) and "v" is the final velocity of the system.

(Both the cart and the falling mass changed in KE)

Case #	Average Velocity	Final Velocity	Potential Energy	Kinetic Energy
Case 1				
Case 2				
Case 3				

## VI. Conclusions:

1. Compare the amount of Potential Energy "lost" by the falling mass with the amount of Kinetic Energy "gained" by the falling mass and rolling cart. Was energy conserved in your experiment? Use data to support your answer.

2. Could errors associated with MEASUREMENT have been a factor in whether or not energy appears to have been conserved in this lab? Which ones?

Yes. Time & Distance Measurement

3. What other sources of experimental error could make it seem as if energy was not conserved in this experiment?

Friction

4. What could be done to improve the lab? Make one suggestion that would increase the accuracy of the experiment and show that energy was conserved.

Use laser timers.

5. Compare the potential energy in case 1 and case 2. Do these numbers make sense? (Are they what you would expect by comparison?) Explain.

2 should be twice as much because hanging mass is twice as much.

6. Compare the kinetic energy in case 1 and case 3. Do these numbers make sense? (Are they what you would expect by comparison?) Explain.

3 is twice as 1 because the total mass is twice as much